UNITED
NATIONS

E

Economic and Social Council

Distr.
GENERAL

E/CN.17/1994/4
22 April 1994

ORIGINAL: ENGLISH

COMMISSION ON SUSTAINABLE DEVELOPMENT
Second session
16-27 May 1994
Item 6 (a) of the provisional agenda*

REVIEW OF SECTORAL CLUSTERS, FIRST PHASE: HEALTH, HUMAN SETTLEMENTS AND FRESHWATER

Freshwater resources

Report of the Secretary-General

CONTENTS

		Paragraphs	Page
INTRODUCTION		1 - 2	3
I.	GENERAL OVERVIEW	3 - 10	3
II.	REVIEW OF PROGRESS ACHIEVED IN THE PROGRAMME AREAS OF CHAPTER 18 OF AGENDA 21 AND INTERNATIONAL COOPERATION	11 - 75	5
	A. Integrated water resources development and management	13 - 25	6
	B. Water resources assessment and impacts of climate change on water resources	26 - 38	8
	C. Protection of water resources, water quality and aquatic ecosystems	39 - 50	11
	D. Drinking water supply and sanitation	51 - 57	14

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CONTENTS (continued)

		Paragraphs	Page
E.	Water and sustainable urban development	58 - 61	15
F.	Water for sustainable food production and rural development	62 - 70	16
G.	New initiatives	71 - 75	18
III.	NATIONAL EXPERIENCE	76 - 96	20
A.	Industrialized countries	76 - 87	20
B.	Developing countries	88 - 95	22
C.	Economies in transition	96	24
IV.	CAPACITY-BUILDING, TECHNOLOGY AND FINANCE	97 - 109	24
A.	Capacity-building	97 - 98	24
B.	Technology	99 - 103	25
C.	Finance	104 - 109	26
V.	CONCLUSIONS AND PROPOSALS FOR ACTION	110 - 119	27

INTRODUCTION

1. In decision 1993/314, the Economic and Social Council approved the provisional agenda for the second session of the Commission on Sustainable Development which, in item 6 (a), provided for a review of sectoral clusters, first phase: health, human settlements and freshwater.

2. In thematic reports such as this, corresponding to the Agenda 21 sectoral clusters, the Commission requested the Secretary-General to include information on the main activities that countries were undertaking or planning (E/1993/25/Add.1, chap. I, para. 28). In order to give the Secretariat sufficient time to analyse the information received, the Commission urged Governments to submit their reports not less than six months prior to the Commission's sessions (E/1993/25/Add.1, chap. I, para. 24). Unfortunately, the Secretariat had received only a few national reports at the time of the preparation of the present report, which is therefore based mostly on information available within the United Nations system.

I. GENERAL OVERVIEW

3. The world population, which in 1990 totalled 5.3 billion people, is expected to increase by approximately 1 billion by the year 2000, with about 93 per cent of the increase taking place in developing countries, particularly in Africa and Asia. Twenty countries with a total population of 131 million people were already in a condition of scarcity in 1990 and another eight countries, with a total population of 203 million were under stress, based on a definition of water scarcity as a per capita availability of freshwater resources of 1,000 cubic metres or less, and of water-stressed as a per capita availability of between 1,000 and 17,000 cubic metres. By the year 2010, 26 countries, with a total population of 416 million, will be under scarcity conditions, and 12, with a total population of 407 million, will be under stress. By the year 2025, a full 35 per cent of the world population will be living under conditions of scarcity or stress, compared with about 6 per cent in 1990. 1/ Already, many countries suffer from water scarcity in some areas, even though on the average they are deemed to have plentiful water resources. In 1987, the World Commission on Environment and Development concluded that some 80 countries, with 40 per cent of the world population, were already suffering from serious water shortages. 2/

4. The availability of freshwater is further affected as a result of serious deterioration of its quality. Most of the sources of pollution that have severely affected the industrialized countries are also present in the developing world and there are few parts of the world that are still exempt from problems of degraded water quality and pollution of surface water and groundwater sources. The waste-assimilative capacity of freshwater bodies adjacent to towns in many developing countries has often been outstripped. There is also increasing concern about the entry of fertilizers and pesticides into surface and ground waters.

5. The rapid growth of urban centres brings with it increased demands for domestic, municipal and industrial uses. Increased levels of population also generate a demand for more food production, with its implications for intensified cropping and increased competition and conflicts among various land and water uses. An estimated 110 million hectares of land with agricultural potential in all developing countries, excluding China, will need to be claimed for human settlements and agricultural use by the year 2010. 3/ While these requirements appear to be small when compared with 1.8 million hectares of land with agricultural potential not occupied by either of these two uses, "land scarcities are very acute in some countries and regions, namely South Asia and Near East/North Africa. Even the small increases foreseen for them are a significant part of their still unused land. 3/ It is further expected that problems related to food production will be exacerbated by a degradation of existing irrigation systems to the point that they have to go out of use. Degradation of soils is estimated to affect some 1.2 billion hectares of land worldwide, of which 450 million are in Asia, 320 million are in Africa, 227 million are on the American continent and 158 million are in Europe. Deforestation and overgrazing are each estimated to account for about one third of the total area affected, while the bulk of the remaining affected area has been caused by mismanagement of arable land. 3/

6. Constraints vis-à-vis the availability of water for agriculture will be even more severe than land constraints. Irrigated agriculture will increasingly have to compete with higher-value uses and, at the same time, it will be expected to produce much more with less water. An estimated 80 per cent of the additional food supplies required to feed the world in the next 30 years will depend on irrigation. 4/

7. Over-extraction of groundwater, while most acute in the Near East, is a growing problem in other areas, including large areas of South Asia, where food is heavily dependent on irrigation. "Overpumping in these areas is causing water levels to fall beyond the reach of shallow tubewells, with the risk that irrigation may eventually become too expensive or physically impractical." 4/

8. Floods continue to exact an increasing toll in life and damages, particularly in the many developing countries that lack forecasting and warning systems. At the other extreme, droughts plague large parts of Africa, Asia and Latin America, killing many people and disrupting development.

9. While in the past there was a tendency to regard water problems as being local or regional in nature, there is a growing recognition that their increasingly widespread occurrence is quickly adding up to a crisis of global magnitude. Water scarcity relative to demand is no longer a problem in arid or semi-arid areas alone, but is now a common occurrence in both developed and developing countries.

10. For a large part of the world, the issue of sustainable land and water resources development is intimately related to the issue of poverty. To the very poor, who may barely eke out a living in rural or peri-urban areas, concerns about degradation of the environment will take a back seat to concerns of day-to-day survival. The modern sector and mass poverty coexist in the vast majority of developing countries. Both bring with them obstacles to the

sustainable development of land and water resources. In poorer countries, the temptation exists to mortgage the future by engaging in development projects that may bring short-term economic benefits but are not sustainable in the long run. While in some cases damage done to the environment might be reversible, it may only be remedied at exceedingly high social and economic costs, or not at all. Without a concerted effort to deal with economic growth, poverty and a more equitable distribution of income, developing countries will not be able to cope with issues related to the long-term sustainability of land and water development.

II. REVIEW OF PROGRESS ACHIEVED IN THE PROGRAMME AREAS OF CHAPTER 18 OF AGENDA 21 AND INTERNATIONAL COOPERATION

11. In chapter 18 of Agenda 21 (Protection of the quality and supply of freshwater resources: application of integrated approaches to the development, management and use of water resources), 5/ the United Nations Conference on Environment and Development (UNCED) emphasized the importance of water resources in all aspects of life, and that the general objective was to make certain that adequate supplies of water of good quality were maintained for the entire population of the planet, while preserving the hydrological, biological and chemical functions of ecosystems, adapting human activities within the capacity limits of nature and combating vectors of water-related diseases. Chapter 18 stresses the multisectoral nature of water resources development in the context of socio-economic development, as well as the multi-interest utilization of water resources for water supply and sanitation, agriculture, industry, urban development, hydropower generation, inland fisheries, transportation, recreation, low and flat lands management and other activities.

12. In chapter 18 of Agenda 21, the Conference approved seven programme areas for action at the national and international levels: (a) integrated water resources development and management; (b) water resources assessment; (c) protection of water resources, water quality and aquatic ecosystems; (d) drinking-water supply and sanitation; (e) water and sustainable urban development; (f) water for sustainable food production and rural development; and (g) impacts of climate change on water resources. The present section provides information on progress and issues concerning the implementation of recommendations contained in these seven programme areas; the programme areas on water resources assessment and impacts of climate change are discussed together. Unfortunately, only a small number of reports have been submitted by Governments on the implementation of the programmes in chapter 18. These have been used together with information available to the organizations of the United Nations system. The present section also describes the activities of the organizations of the system in the implementation of the programmes, based on a task manager report prepared through the Subcommittee on Water Resources of the Administrative Committee on Coordination (ACC).

A. Integrated water resources development and management

13. Modern water legislation has considerably broadened the type and scope of issues to be considered in the regulation of water resources. In particular, there is a clear trend to link water legislation to economic and environmental issues, with a strong focus on quality aspects and pollution control, and concern with integrated and efficient water resources planning, with emphasis on river basin and regional planning. Water planning is being coordinated with planning for other natural resources and economic and social objectives. More concern is being shown with the development of appropriate information and guidance for policy makers, administrators, users, purveyors of water services and the public at large, and with the inclusion of provisions for public participation. 6/

14. Nevertheless, the management of water resources in developing countries remains generally fragmented. In the light of the serious economic and political problems being faced in Africa, little if any significant success is evident in this regard, and the fragmentation of institutional responsibilities hinders the formulation of holistic approaches for the integrated development of water resources.

15. The most recent survey conducted by the Economic and Social Commission for Asia and the Pacific concerning the implementation of the Mar del Plata Action Plan 7/ was completed in May 1991. The countries responding to the survey indicated that considerable progress had been made by countries in the region towards the formulation of national water policies and comprehensive master plans. Nevertheless, the majority of the respondents felt that their existing regulations were not sufficient or were incompatible with existing development plans. Although floods are a major concern to the majority of the countries in the region, most of them have no adequate structural or non-structural measures.

16. Water management in Latin America remains far from optimum, despite the progress made in the application of scientific management techniques. This is especially the case in regions where the use of the resource of water is most intensive and conflictive. Many issues inherent to water system operation are being poorly handled and even ignored. This is the case, almost without exception, with respect to the maintenance of infrastructure. There is some evidence, however, that the establishment of a clear distinction between responsibility for the management of the resource and responsibility for the management of its use can be beneficial. Private sector or user participation in management can be a valuable tool towards achieving that distinction.

17. Water legislation in Western Asia is deemed to be generally complex and outdated with regard to modern management practices and techniques, and has resulted in the fragmentation of administrative responsibilities. Provisions which regulate water resources development and management are often contained in different laws and regulations, or have originated from traditional and customary uses which relate to the prevailing social structure of some member countries. A number of countries, including Jordan, the Syrian Arab Republic, Iraq and the Gulf States, have recently carried out critical examinations of their legislative structures. 8/

18. As far as Europe is concerned, the Convention on the Protection and Use of Transboundary Watercourses and International Lakes has been signed by 25 countries and the European Community, and ratified so far by Albania, Norway, the Republic of Moldova, the Russian Federation and Sweden. Issues regarding the prevention of, preparedness for, and response to industrial accidents, in particular those with accidental pollution of transboundary waters, are covered in the 1992 Convention on Transboundary Effects of Industrial Accidents.

19. With regard to the organizations of the United Nations system, through the ACC Subcommittee on Water Resources, they are engaged in the process of formulating strategies for accelerating progress in the area of integrated water resources development and management. Work in this regard has been initiated with the Department for Development Support and Management Services of the United Nations Secretariat, the World Bank, the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP) as lead agencies.

20. A capacity-building approach defined by UNDP in 1991 was further refined at the International Conference on Water and the Environment (Dublin, January 1992) and at the United Nations Conference on Environment and Development (Rio de Janeiro, June 1992), a series of water sector assessments in developing countries were carried out by the Department for Development Support and Management Services in cooperation with the World Bank. The latter engaged in a revision of its policies and published a policy paper in 1993. 9/ In view of the fact that the largest proportion of freshwater is used for agricultural production, the Food and Agricultural Organization (FAO) formulated water policy guidelines related to agriculture, and included a chapter on water policies and agriculture in its recent publication, The State of Food and Agriculture, 1993.

21. The Department for Development Support and Management Services, together with UNDP, has carried out a number of pilot sector assessments or diagnostic studies in such countries as Bolivia, India, Morocco, Nepal, Peru and Yemen. Further work is envisaged in China, Madagascar, Papua New Guinea and the countries of the Southern African Development Community. The approach has been found to be most useful in formulating UNDP country programmes in the context of national development plans and priorities, particularly in the context of capacity-building.

22. Another initiative in this area concerns the collaboration of the Department for Development Support and Management Services and UNEP, with the close support of UNDP and the World Bank, in launching the Freshwater Consultative Forum. One of the important conclusions of the first meeting of the Forum, which was convened from 13 to 16 December 1993, was that UNEP and UNDP should choose an existing river or lake basin organization with a critical need, where the various recommendations for improving water resources management could be applied.

23. UNEP is continuing to refine and apply its comprehensive, multi-disciplinary approach to integrated management of freshwater resources. It also works to assist Governments to integrate fully the environmentally sound management of natural resources into national plans for social and economic development. To date, UNEP activities in this area have been completed for the

international drainage basins of the Zambezi River, Lake Chad, the Aral Sea and Lake Titicaca. Activities are in the planning or consultative stage for the Nile, Mekong, Orinoco, Catatumbo and San Juan rivers, the Caspian Sea and selected island States.

24. One of the three key areas of concentration of the Institute on Natural Resources in Africa of the United Nations University (UNU/INRA, Accra, Ghana) relates to soil and water conservation for environmental management in Africa. Even though it is clear that women have an important role to play in the management of water resources, this important dimension has mostly been neglected in the past. In this regard, the International Research and Training Institute for the Advancement of Women (INSTRAW) has been instrumental in bringing to the fore the need for the greater involvement of women in the development and management process.

25. The Economic Commission for Africa (ECA), in collaboration with the Organization of African Unity, finalized a Protocol in Natural Resources including Water Resources Development in Africa. In 1993, the ECA prepared a comprehensive study on problems, prospects and strategies for cooperation among riparian countries for the integrated water resources development of the Nile River basin, and published a detailed study on the conservation and rational use of water resources in six North African countries. The Economic Commission for Europe (ECE) was instrumental in the development and adoption of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes. ECE has also prepared a review of national strategies and policies for the protection and use of transboundary waters, and has drawn up a consolidated list of bilateral and multilateral agreements and other arrangements in Europe and North America on these issues. Work is also being pursued on the development of instruments to promote sustainable water management. The Economic Commission for Latin America and the Caribbean (ECLAC) has prepared a number of reports on the subject of integrated water resources management, and acts as the secretariat of the Latin American and Caribbean Network for Integrated Water Management, which consists of institutions dealing with this question. It also organizes courses on water resources management in various countries of the region. ECLAC, jointly with UNEP, has organized a workshop to discuss the follow-up in the regions of the recommendations of chapter 18 of Agenda 21 with regard to water management policies in Latin America and the Caribbean. In 1991, ESCAP organized a regional Workshop on Sustainable Development and Environmentally Sound Development of Water Resources, and prepared papers on an integrated approach to the efficient development, management and use of water resources. The Economic and Social Commission for Western Asia (ESCWA) convened a Symposium on Water Use and Conservation in November 1993.

B. Water resources assessment and impacts of climate change on water resources

26. Regional assessments carried out in 1990 by the World Meteorological Organization (WMO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) with regard to the implementation of the Mar del Plata Action Plan during the 1980s indicated that in the late 1970s there was evidence that countries were developing and strengthening their water resources

assessment programmes. However, the trend suffered a reversal in the mid-1980s under pressure of economic stringency. The survey gave cause for concern that, at a time when greater demands were being made for more precise information about the availability, variability and reliability and quality of water resources data, data collection and analysis had fallen behind water development and management needs. 10/

27. The modest increases that were achieved in Africa during the early 1980s later gave way to a deterioration in equipment and its operation owing to a lack of funds and trained staff. The situation in the ESCWA region and in countries north of the Sahara was found to be similar to that of Sub-Sahara Africa. A general deterioration of operation and maintenance and database management procedures were found to be problems in these regions. The survey found that good progress had been made in the ESCAP region with regard to the collection of project-oriented water data, in establishing computerized databanks and in preparing generalized water resources information. Problems of coordination among a diversity of agencies dealing with water resources assessment were found to exist, and the operation and maintenance of the diversity of equipment used was a cause for concern. Overall coverage of hydrometeorological and surface networks in the ECLAC region was deemed to be fairly well matched to development needs. However, few attempts were made towards the integration of data into a resource management system. Within the ECE region networks were found to be comparatively well established, with the exception of large parts of northern Canada, northern Scandinavia and the former USSR, which had only rudimentary services in place. Many different assessment and interpretative techniques, as well as modern hydrometric technology and database management techniques, are routinely applied.

28. Since the completion of the survey, there has been little evidence to indicate that major positive changes have taken place or that progress has been achieved. The situation in Africa continues to be critical. The World Bank project aimed at evaluating the status of existing water resources assessment capabilities of the sub-Saharan countries concluded that, "few countries now have services which can be compared favourably with those existing 10 and 20 years ago. No country has a service which is adequate as a basis for sustaining the many water developments which can be expected in the region in the coming decades". 11/ The study goes on to conclude that, "manpower is rarely sufficient to allow data collection agencies to meet their obligations, with establishments being too small and manpower skills insufficient for the workload". 11/ Latin America and the Caribbean, as well as Asia and the Pacific, continue to face considerable problems. In addition, conditions in Eastern Europe and the successor States of the former USSR have recently worsened to the extent that many countries in Eastern Europe and Central Asia have suffered serious reductions in their hydrological services.

29. In order to coordinate their programmes better, UNESCO, together with WMO and the International Council of Scientific Unions (ICSU), convened an International Conference on Hydrology (Paris, 22-26 March 1993). The Conference agreed on the Paris Statement with five recommendations, including one to achieve even closer partnership between the two agency programmes at the national and international levels. One expression of the partnership between UNESCO and WMO is the publication, in 1988, of the first edition of the

UNESCO/WMO Water Resource Assessment Activities: Handbook for National Evaluation, which allows national bodies to assess their capabilities in water resources assessment. The second edition will place greater emphasis on water quality, grourdwater and other aspects of water resources assessment not dealt with adequately in the first edition. Within its International Hydrological Programme (IHP), UNESCO is developing a hydrological research programme aimed at the appropriate assessment of the available water resources of the world in order to meet the needs for water supply, agriculture and industry.

30. Transfer of hydrological technology through the ongoing WMO technology transfer system, known as the Hydrological Operational Multipurpose System (HOMS), has continued. Many of the components deal with water resources assessment, but some, such as those for the design of flood forecasting systems, are relevant to disaster mitigation and the International Decade for Natural Disaster Reduction. Since HOMS commenced in 1981, nearly 3,000 transfers of technology have been undertaken, the majority from North to South, but some North-North and some South-South.

31. The Department for Development Support and Management Services and WMO have participated in the activities of the Steering Committee of the World Bank/UNDP project on Sub-Saharan Hydrological Assessment in Africa, jointly financed by UNDP, the World Bank, the African Development Bank, the European Community and French bilateral contributions. The aim of the project is to diagnose the gaps in the hydrological and hydrogeological monitoring networks and to assess the institutional capabilities of hydrological and similar agencies in the region.

32. WMO continues its efforts in disaster mitigation relating to floods, avalanches, landslides and droughts. Efforts are also being made to promote the use of weather radar for hydrological forecasting and warning, particularly within Europe. WMO has established two drought monitoring centres in Africa, one at Nairobi and the other at Harare. Its involvement in the planning for the International Decade for Natural Disaster Reduction has led to several projects being undertaken especially for the Decade.

33. Water-related natural disaster reduction activities have been carried out by ESCAP with the aim of strengthening the disaster preparedness and mitigation capabilities of member countries. In 1993, ESCAP conducted roving seminars on comprehensive flood loss prevention and management in Myanmar, Pakistan, the Islamic Republic of Iran and Solomon Islands. ECLAC, with the cooperation of the Government of Italy, has prepared a manual on disaster preparedness to assist countries in the region to deal with water-related natural disasters.

34. While uncertainty remains about the future climate on a global, regional or smaller scale, there is no uncertainty that water resources will change more drastically as a result of climate change than any other sector, and that these effects will in turn have an impact on other sectors. Higher temperatures worldwide and the higher evaporation rates they will bring, if coupled with lower precipitation, would lead to a reduction in world water resources. However, in some regions precipitation may increase, and higher atmospheric carbon dioxide concentrations may increase the water-use efficiency of many plants, especially in drier regions.

35. These changes are likely to be exacerbated where sealevel rise poses a threat to low-lying areas, particularly in the case of small islands. In this regard, it is expected that sealevel rise would endanger coastal groundwater resources through saline intrusion, especially in small islands where the recharge area would be reduced. Changes in rainfall amount, duration and seasonal distribution may adversely affect groundwater recharge and rainwater harvesting for small islands. Increases in the frequency and severity of tropical cyclones, hurricanes and typhoons may result from higher sea surface temperatures, with a consequent increase in storm damage and flooding reinforced by sealevel rise.

36. The proposed World Hydrological Cycle Observing System (WHYCOS) (see para. 72 below) will offer the opportunity to overcome some of these problems, particularly on a global scale. However, a more detailed project, which concentrates on the hydrological regime of several sets of small islands situated in different climatic regimes is needed. WMO has been involved in initial proposals for such a project and, together with UNEP, WHO and UNESCO, it also convened a Workshop in Trinidad and Tobago from 5 to 9 July 1993, which dealt with water quality issues in small islands.

37. Through the World Climate Programme-Water (WCP-Water), WMO, UNESCO, UNEP and FAO, with the participation of non-governmental organizations, national institutes and bodies, address the problem of climate change and water resources. In a related initiative, FAO, ICSU, UNEP, UNESCO and WMO are cooperating in the planning phase for a Global Terrestrial Observing System (GTOS) on longer-term changes in natural and agro-ecosystems, including hydrological features.

38. ECLAC, in November 1993, convened a regional expert meeting on the possible effects of climate change on water resources in Latin America and the Caribbean. ESCAP formulated a project on potential effects of climate change on water resources and related economic activities.

C. Protection of water resources, water quality and aquatic ecosystems

39. The 1990 WHO/UNEP assessment of progress in the implementation of the Mar del Plata Action Plan with regard to water quality concluded that most of the sources of pollution that have severely affected the industrialized countries are also present in the developing world, whereas measures for preventing or at least limiting the degradation of water quality, and even for the assessment of its scale and trends, are not generally applied. Furthermore, the ever-increasing population pressure and, more worrying, the rapid growth of urbanization are causing a dangerous concentration and acceleration of pollution and the deterioration of water quality in surface and groundwaters. 12/

40. Bacteriological pollution, organic wastes, suspended solids, organic micro-pollutants, nitrates, eutrophication and salinization were ranked as the major pollution issues in developing countries, in decreasing order of severity.

41. In the Latin America region, one of the main causes of water pollution is the direct discharge of domestic sewage and industrial effluent into watercourses. There is a lack of wastewater treatment plants for any but the most toxic industrial wastes. Virtually all municipal sewage and industrial effluent is discharged into the nearest rivers and streams without any treatment. Agriculture through irrigation has given rise to high salinity affecting soils, surface waters and groundwater, and through the use of fertilizers and pesticides has caused the eutrophication of water bodies and levels of chemical residues dangerous to human life and aquatic biota.

42. The reports on both East and West Africa express very similar concerns, with emphasis on bacteriological content, organic waste loading, suspended solids and nitrates as major pollutants, and with the threat of increased problems from intensified agriculture and the associated expansion of fertilizer and pesticide use. Many of the shallow groundwater resources appear to be becoming contaminated by pathogenic agents, largely from domestic sources, but there is little systematic water quality monitoring to assess such trends in most of the countries studied.

43. The major aspect of water quality in the Western Asia region is that of salinity, associated closely with the large proportion of water used for irrigated agriculture, and thus the heavy demands mainly on groundwater sources. The lack of detailed information on water quality in this region appears to lie in a general absence of monitoring, which may be obscuring the presence of problems or trends towards their development.

44. The Asia and Pacific region presents problems similar to those of the other regions but, with its large and highly concentrated populations in the major countries, their scale is magnified accordingly. Sedimentation is proving damaging and costly to control in many river basins, arising from improper land management practices in upper catchments, where the pressure of growing populations exceeds the capacity of available, suitable agricultural land.

45. With regard to the activities of the organizations of the United Nations system, UNEP is co-sponsoring a number of programmes which relate directly to water quality protection. One is the Global Freshwater Quality Monitoring Programme (GEMS/WATER), the other is the International Union for Conservation of Nature and Natural Resources (IUCN), which deals with ecological aspects of water resources. Linkage with health protection objectives is maintained by WHO through the GEMS/WATER programme of UNEP, and also through its work on water pollution control. FAO is linking up through its recently established interdepartmental working group on pollution of natural resources. The disease control and eradication programmes of WHO, notably diarrhoeal diseases, guinea worm, schistosomiasis and river blindness, as well as the Joint WHO/FAO/UNEP/United Nations Centre for Human Settlements (Habitat) Panel of Experts on Environmental Management for Vector Control (PEEM), have a crucial impact on the way in which water resources are being managed. The hydrological aspects are dealt with by two programmes, IHP of UNESCO and the Operational Hydrology Programme (OHP) of WMO.

46. In addition to its work on the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, ECE has adopted policy

recommendations to Governments on water quality criteria and objectives for surface waters and their high ecological state, as well as policy guidelines on the ecosystem approach in water management. ESCAP is organizing an expert group meeting on the protection of water resources, water quality and aquatic ecosystems, to be held from 17 to 21 October 1994, with a view to formulating recommendations on ways to strengthen national capabilities for the protection of surface and ground waters.

47. The UNEP regional offices play an important political role in bringing countries together on water resource and pollution issues. Water quality monitoring services have been supported in a number of countries in Latin America, Africa and Asia through training of laboratory staff, provision of computer equipment and quality control services. Twinning arrangements between collaborating centres in developed countries and national and regional laboratories in developing countries were established for this purpose. Water pollution assessment and pollution control advisory services have been provided in several international river basins, for example the equatorial lakes and upper Nile, the Zambezi, the Mekong and the Rio de la Plata. In addition, national hydrological institutions were assisted in their efforts to deal with water quality problems. To this end, water authorities in the Caribbean were brought together to propose regional activities and to provide an input to the United Nations initiative on small island States. The assessment of water quality as a prerequisite for management has been launched in the Asia and Pacific region and throughout the territory of the former Soviet Union.

48. Advances in the protection of human health from contamination of water sources have been made through the revision of the WHO Guidelines for Drinking-Water Quality, which will provide the basis for regulatory action on pollution control, and the prevalence of water-associated diseases has been further reduced by intensive campaigns for guinea worm eradication in the affected countries. The protection of groundwater receives growing attention, and collaborating centres have been nominated by WHO for this purpose. Training is given to national water resource managers in Latin America, and region-wide studies were launched in the Pacific region. Pilot studies on aquifers underlying urban areas were completed in several regions.

49. In 1994, the Council of the United Nations University established an International Network on Water, Environment and Health (UNU/INWEH) as a joint international programme of the University and a Foundation in Ontario, Canada, established by the government of Ontario. The themes to be addressed by UNU/INWEH include general environmental impact assessment; protection and recovery of water supplies; toxicology; water supply and sanitation; wastewater treatment, remediation and reuse; and human health.

50. Considerable efforts have been made to improve cooperation since the preparatory process of UNCED, particularly with a view to bringing hydrology and water quality sciences close together. Annual meetings of the GEMS/WATER Steering Committee are used to streamline the activities of UNEP, WHO, UNESCO, WMO and FAO. The Water Supply and Sanitation Collaborative Council, at its second meeting (Rabat, September 1993), established a Council-mandated working group on water pollution control, designed to bring together United Nations organizations, other international organizations, non-governmental

organizations, bilateral donors and developing country representatives of the water sector in a joint effort to curb pollution of water resources.

D. Drinking-water supply and sanitation

51. Improved information concerning water supply and sanitation coverage at the country level is being obtained through the WHO/United Nations Children's Fund (UNICEF) Joint Monitoring Programme. Based on the information received from countries in the African region, the percentage of the urban population with safe water supply and adequate sanitation in 1990 is significantly lower than had been previously estimated. More than 25 per cent of the people in Africa have no access to safe water supply, and more than 40 per cent do not have adequate sanitation. Under such conditions, the lack of coverage expected by the year 2000 becomes alarming. The newly reported figures for rural water supply also indicate a lower coverage than had been initially reported. By contrast, the percentage of rural inhabitants with adequate sanitation appears to be higher.

52. In the case of the Asia and Pacific region, the new data indicate that, in urban and rural areas, there is a higher proportion of people with safe water supply, but there is a lower proportion of people with adequate sanitation services. The decreasing trend in relative urban sanitation coverage by the year 2000 remains a cause for serious concern. The number of countries providing information in the Latin America and Caribbean region and in Western Asia do not provide a sufficiently representative sample of the regions' total population to allow a revision of the previous data.

53. With regard to funding, the preliminary data obtained through the Joint Monitoring Programme leads to the conclusion that, "priority investment in water supply and sanitation has continued in the urban sector. Moreover, the bulk of this funding has been directed towards the better-off population". 12/

54. Since the United Nations Water Conference in 1977, and the International Drinking Water Supply and Sanitation Decade which followed, there has been much greater emphasis on the importance of international cooperation and on dealing with problems concerning drinking water supply and sanitation. In this context, following UNCED, the Government of France convened a Round Table on Water and Health in Under-privileged Urban Areas at Sofia Antipolis, from 21 to 23 February 1994. In addition, the Government of the Netherlands convened a Ministerial Conference on Drinking-Water and Environmental Sanitation at Noordwijk on 22 and 23 March 1994 (see E/CN.17/1994/12), which was preceded by a preparatory meeting of senior civil servants, held from 19 to 21 March.

55. Increasingly, United Nations organizations are developing cooperative programmes and activities with each other. A good example of meeting the needs of appropriate technologies and innovative developmental approaches is the UNDP/World Bank Water and Sanitation Programme. Another example of cooperation is the WHO/UNICEF Joint Monitoring Programme, whose goal is to strengthen or establish national capabilities for monitoring water supply and sanitation activities.

56. Other important inter-agency programmes having water supply and sanitation components include the Joint WHO/FAO/UNEP/United Nations Centre for Human Settlements (Habitat) Panel of Experts on Environmental Management for Vector Control (PEEM); the joint strategy for hygiene education in water supply and sanitation in the 1990s, which UNICEF and WHO have begun to develop; the collaboration between the UNDP/World Bank Water and Sanitation Programme and WHO on hygiene education activities in Africa and Asia; the UNDP/World Bank/UNEP Urban Management Programme; and the Task Force on Women, in which the Department for Development Support and Management Services, INSTRAW, UNICEF and the UNDP/World Bank Water and Sanitation Programme have been cooperating. In order to foster the greater involvement of women in the development and management process, INSTRAW, in cooperation with the Department for Development Support and Management Services and the International Labour Organization (ILO), developed multi-media training packages on women and water supply and sanitation. Funded by the Department, regional seminars for testing the revised modules were carried out in Africa (the Gambia, September 1991) and in Asia (Bangladesh, September 1992). In the case of Latin America and the Caribbean, ECLAC plans to prepare a study on the experiences of the countries of the region concerning the restructuring of the operation of water supply and sanitation companies, including their privatization, with emphasis on the role of tariffs in achieving greater efficiency and effectiveness in the provision of services.

57. The Inter-Agency Steering Committee for Water Supply and Sanitation has long played a central role among United Nations organizations. In November 1993, it became a working group of the ACC Subcommittee on Water Resources, with the responsibility for coordinating the implementation of joint drinking water supply and sanitation activities of the United Nations system. The Steering Committee is intended to perform a catalytic role with regard to the development of joint activities, and to establish a network of collaboration among relevant organizations. In a broader context, the Water Supply and Sanitation Collaborative Council is the main mechanism for the coordination of the overall policies and programmes of United Nations organizations with non-governmental organizations, bilateral organizations and other external support agencies. The Council established a working group on urbanization at its meeting in Oslo, in 1991. The Working Group was entrusted with the task of developing a strategy for the improved provision of services to urban areas. The activities of the Working Group are currently being continued by the Council's mandated activity on services for the urban poor.

E. Water and sustainable urban development

58. The availability of safe water in urban centres is fast becoming one of the most important factors limiting socio-economic development. In 1980, 19 of the 30 largest urban agglomerations were located in developing countries. By the year 2000, the total is expected to increase to 22, each with an estimated population ranging between 6.7 to 22.6 million people. Two cities in Asia (including Japan) had, in 1980, a population exceeding 10 million. By 1990 there were seven such cities, and it is estimated that their number will grow to 13 by the end of the century. By the year 2000, some 24 million people in Africa will be living in two cities with populations exceeding 10 million, and the population in cities with 1 to 5 million people will have grown by more than

350 per cent since 1980. In Latin America and the Caribbean, the population living in cities with 1 to 5 million people and over 10 million people will more than double over this 20-year period.

59. As a response to the rapid pace of urbanization in developing countries, and the escalating demands for the improved management of water resources, water supply, sanitation and drainage in urban areas, most organizations of the United Nations system are giving increasing attention to the execution of activities related to water and sustainable urban development. Some examples of this trend include the UNESCO/WMO initiatives on urban hydrology; the urban water supply and sanitation components of the UNDP/World Bank Water and Sanitation Programme; the growing activities of UNICEF in peri-urban areas; the inclusion of a special subprogramme to attend urban problems in the new WHO Enhanced Programme for the Promotion of Environmental Health; and the activities on water resources and urban infrastructure management being implemented by the United Nations Centre for Human Settlements (Habitat) Settlements Infrastructure and Environment Programme, the Sustainable Cities Programme and the Urban Management Programme.

60. Specific activities in response to Agenda 21 include the introduction of environmental impact assessment for major water resources development projects related to urban areas; the implementation of resource allocation decisions; the development of legal and institutional frameworks and planning mechanisms for the integrated management of urban development and water resources within a watershed; the protection of watershed from depletion and degradation of their forest cover and from harmful upstream activities; the promotion of public participation for the collection, recycling and elimination of wastes; efforts to mobilize and facilitate the active involvement of women in water management teams; the introduction of water tariffs, where affordable, which reflect the marginal and opportunity cost of water, especially for productive activities; promotion of the allocation of resources according to economic, social and environmental criteria; and the implementation of urban storm water runoff and drainage programmes.

61. The activities of the United Nations regional commissions, WHO and the UNDP/World Bank Water and Sanitation Programme have strong regional components. ESCAP, in close cooperation with the regional offices of WHO and the UNDP/World Bank Water and Sanitation Programme, held a regional seminar on water resources management in urban areas from 22 to 26 March 1993. ECLAC has been engaged in a project to provide medium-sized cities with improved planning and management capacity of water supply utilities. National activities in support of sector monitoring and assessment are also executed by the World Bank, UNICEF and WHO.

F. Water for sustainable food production and rural development

62. During the past four decades, irrigated agriculture provided a major part of the increase in production to meet population demands. By the mid-1990s, 35 per cent of total crop production came from less than 16 per cent of the arable land which was irrigated. On a global basis, the average rate of expansion was about 1 per cent per year in the early 1960s, reaching a maximum of 2.3 per cent per year from 1972 to 1975. The rate of expansion began to decrease in the mid-1970s, and is currently about 1 per cent per year.

Construction costs have risen steadily and world prices for major cereals have fallen sharply, and progressively less favourable and therefore more expensive areas are left for further expansion.

63. The FAO projection (World Agriculture Toward 2000) 13/ of expansion of irrigated land to the year 2000 was 2.25 per cent per year from 1982/84 to 2000. About two thirds of the increase in arable lands would be accounted for by expansion of irrigation. 14/ The World Bank estimates that although it will take an average annual growth rate of 2 per cent in agriculture as a whole to feed a world population estimated to reach 6 billion by the year 2000 and 8 billion by the year 2025, the growth rate for irrigated agriculture will need to be 3 per cent per year. Recent indications show that it will be difficult to sustain a 2.4 per cent annual growth in irrigation expansion in developing countries as predicted earlier. 15/

64. FAO estimates that, if major starvation is to be avoided, a minimum of 15.2 million hectares, at an estimated cost of US$ 45.52 billion, need to be brought into irrigated agriculture by the year 2000, over and above the 172.1 million hectares under irrigation by 1990. In addition, out of the 172 million hectares under cultivation by 1990, an estimated 17.21 million need to be upgraded by the end of the century, at an estimated cost of US$ 13.4 billion. An estimated 20 to 30 million hectares, globally, are severely affected by salinity and an additional 60 to 80 million are affected to some extent. The estimated cost for the provision of such drainage facilities at a rate of 1 million hectares per year for the remainder of the decade would amount to US$ 7 billion over the seven-year period, ending with the year 2000.

65. Agricultural requirements in the years to come will also necessitate the intensification of production in high-potential rain-fed lands where intensification will not result in overexploitation of the natural resource base or in environmental degradation. The improvement of a total area of about 10 million hectares within the period 1993-2000, constituting 2.5 per cent of the total high-potential rain-fed lands, would cost an estimated US$ 7 billion. In addition, approximately US$ 14 billion will be required over the same period for investments in aquaculture development.

66. An integrated approach to rural water management necessitates inter-disciplinary and inter-agency efforts for implementing the programmes at local, national, regional and global levels. With this in mind, a Technical Consultation on this subject was convened by FAO in March 1993, in close collaboration with UNICEF, UNDP, the World Bank and WHO, which produced broad guidelines for programme implementation and a number of specific recommendations for action. The Consultation underscored the importance of national water sector assessments, which have already been initiated under the programme area of integrated water resources management as a starting point for the identification of capacity-building needs and priorities.

67. An informal consultation on land/water linkages and river basin management was held in Rome from 31 January to 2 February 1994, sponsored jointly by FAO and the Natural Resources Management Institute of the University of Stockholm. The consultation aimed at developing a conceptual framework to predict land/water/environment interactions; establish a landscape and river-basin

approach to integrated land and water resources management; and draft a programme of action, including strategies and models for integrated water/land management on a landscape-ecological and catchment area basis.

68. The International Action Programme on Water and Sustainable Agricultural Development (IAP-WASAD), which was initiated in 1991, concentrates on action at the national, subregional and regional levels. Its goal is to assist member countries in meeting their freshwater needs for sustainable agriculture and rural development through formulation and implementation of action programmes in partnership with relevant United Nations organizations and multilateral and bilateral donor agencies. To date, national and subregional action programmes have been formulated in Egypt, Indonesia, Mexico, the Syrian Arab Republic, Turkey, the United Republic of Tanzania and Zimbabwe and in the Lake Chad basin. Activities are being initiated in Egypt, Indonesia and Turkey for the implementation of their respective programmes.

69. Comprehensive rural water supply programmes, based on village-level management and maintenance, are being carried out in many Sahelian countries by the Department for Development Support and Management Services with funding from UNDP and the United Nations Capital Development Fund (UNCDF). The Department and UNICEF have cooperated in the Niger and in Guinea-Bissau with the World Bank/UNDP joint programme for the Promotion of the Role of Women in Water and Environmental Sanitation Services (PROWWES).

70. A lack of adequate water for drinking and livestock sanitation in many arid and semi-arid regions of developing countries can seriously affect economic and social viability of pastoralism. FAO is focusing attention on the provision of drinking-water points, including water troughs in the semi-arid and arid pastoral lands of Africa. Joint activities with the UNESCO Man and the Biosphere (MAB) Programme on the impact of human activities and land use practices in grazing lands are being implemented. With regard to fisheries and aquaculture, FAO activities in support of these areas include a regional technical assistance project on Environmental Assessment and Aquaculture Development, covering 14 countries in the Asia and Pacific region.

G. New initiatives

71. As part of the activities within the ACC Subcommittee on Water Resources concerning the development of strategies for integrated water resources development and management, efforts are being made to assist developing countries in carrying out diagnostic studies of their institutional capacity, with a view to formulating water resources development strategies and policies. These efforts will seek to bring about a more multidisciplinary and inter-agency approach in order to ensure an integrated assessment of country situations and needs. Efforts are being carried out for the establishment of an integrated information network. The initial efforts of this incipient programme have been directed towards identifying available information and data gaps.

72. In response to the needs expressed by the International Conference on Water and the Environment and the recommendations contained in chapter 18 of Agenda 21, UNESCO and WMO, with the support of the World Bank, are promoting a

major long-term initiative to improve knowledge of the hydrological cycle through the development of a World Hydrological Cycle Observing System (WHYCOS). The initiative aims at alleviating the deficiencies that exist at the national, regional and global levels with respect to data required for effective water resources management and sustainable development. The proposal envisages the creation of a world-wide network of key stations linked by satellite with an associated quality-controlled database. The WHYCOS network would measure river flow and water quality variables, as well as on-bank temperature, humidity, radiation, wind speed, barometric pressure, precipitation and several related variables. It would employ the existing WMO World Weather Watch system, where applicable, and would in turn contribute data to it, as well as to the Global Climate Observing System and to the Global Terrestrial Observing System. In view of the seriousness of the situation in Africa, the initial focus of attention of the WHYCOS programme would be in that region, and the programme would extend over a period of 20 years. The estimated funding for the initial six-year period has been estimated at US$ 14 million. Similar approaches are being developed for Latin America and the Caribbean, for countries bordering the Mediterranean Sea and for the basin area of the Aral Sea.

73. A step towards regional cooperation was taken in 1993 when both the ACC Subcommittee on Water Resources and the Steering Committee for Water Supply and Sanitation recognized that the deteriorating water and sanitation situation in Africa required a special inter-agency effort to develop innovative and cooperative water resources development and management programmes to meet the most pressing needs of the region. WHO has been assigned responsibility to coordinate this effort on behalf of the Subcommittee, in consultation with UNDP, UNEP, FAO, ECA and other relevant organizations.

74. Within FAO, a number of Special Action Programmes are being established. One such Programme is on Rural Use of Water Resources for Sustainable Agricultural Development (SAP-WASAD), which is complementary to the ongoing Inter-agency Programme on Water and Sustainable Agricultural Development. The objective of SAP-WASAD is to promote a stronger inter-disciplinary approach to water management within agriculture, forestry and the fisheries subsectors under the FAO International Cooperative Programme Framework for Sustainable Agricultural and Rural Development (related to chap. 14 of Agenda 21).

75. Attention is drawn to the recommendations made by the Committee on Natural Resources, at its second session, addressed to the Commission on Sustainable Development. In particular, the Committee called for the formulation of an implementation plan to avert the pending water crisis, incorporating principles for the effective management of land and water resources, and guidelines and schedules based on Agenda 21 (E/C.7/1994/L.7, para. 5 (b)). The Committee further recommended that the Commission, "approve the formulation of the plan by the Working Group on Water of the Committee on Natural Resources jointly with the Administrative Committee on Coordination Subcommittee on Water Resources, drawing upon the results of the regional meetings of the United Nations Environment Programme already scheduled to address the issue and other relevant activities of the organizations and specialized agencies of the United Nations (E/C.7/1994/L.7, para. 5 (d) (ii)).

III. NATIONAL EXPERIENCE

A. Industrialized countries

76. As part of Canada's efforts to ensure that economic development takes place on a sustainable basis, provincial governments are moving towards an ecosystem approach to analysing environmental issues and to strike the necessary balance between competing demands. This has impacts on water management. Governments and major groups have worked together on a series of integrated assessment and environmental management plans for some of Canada's major river basins and the Great Lakes. Laws and regulations in more jurisdictions have been strengthened to expand protection of waterways and aquatic ecosystems. Regulations under federal and provincial legislation have been revised to set stricter limits on effluent discharges from pulp and paper mills. Fines and other penalties have been substantially increased for federal fishery offences, such as illegal dumping or the damaging of fish habitat. A new Canadian Environmental Assessment Act was proclaimed in 1993 and associated regulations are being developed.

77. Partnerships have become fundamental to addressing freshwater issues. One is the work of the Canadian Council of the Ministers of the Environment in developing a water strategy. This includes water conservation initiatives, water quality guidelines and development of a work plan for aquatic ecosystem health. Non-governmental organizations have recently organized a national water caucus under the auspices of the Canadian Environmental Network, in order to help the many environmental organizations working on local and regional water issues to share information, develop joint strategies and provide advice to governments. Several Canadian non-governmental organizations jointly organized the International Secretariat for Water, an international non-governmental organization headquartered in Montreal. Its aim is to foster cooperation among non-governmental organizations of all countries that are involved in drinking water and sanitation improvement for people in the southern hemisphere.

78. In a new national Action Plan for Fish Habitat, governments, groups representing indigenous people, industry and non-governmental partners in fisheries management are launching a programme to streamline the division of management responsibilities and to provide techniques and policies for local fish habitat management. It will address partnership arrangements, inventory and monitoring of resources, environmental analysis, regulations and guidelines, and planning and evaluation.

79. In Finland, an Environment Impact Assessment Act will shortly be laid before the Parliament. Impact assessment procedures are applied to projects which may have major environmental consequences. Assessment under other legislation will be part of environmental impact assessment under the envisaged Act in order to integrate different environmental sectors. An administrative overhaul is being undertaken. Issues regarding water protection and management, air protection, waste management, nature conservation and land use planning are assembled under new regional organizations and environmental district offices. The Government has approved long-term objectives until 1995 for the protection of waters, based on water use requirements and on safeguarding the functioning of ecosystems. A proposal for a conservation programme for waters was completed

in 1992. The plan covers 68 watercourses and parts of watercourses, which all have international or national conservation value. The approval process is presently under way.

80. The Finnish-Norwegian Commission on transboundary watercourses has drawn up integrated water resources development plans for the Tenojoki and Naatamonjoki river catchment areas. Finland and the Russian Federation have agreed on an action plan for water pollution control for their common transboundary watercourses. The action plan contains a comprehensive system for reporting on pollution loading in the area.

81. With regard to development assistance, the recommendations of UNCED have been incorporated in the new development strategy. The main targets in the development strategy are alleviation of poverty, improvement of democratic rights and a sustainable environment.

82. An Environmental Impact Assessment Act was adopted in Iceland in the spring of 1993 and new laws are being prepared for the protection of freshwater resources. Pollution control regulations have been tightened to meet European water quality standards. Action plans for the integration of environmental considerations into all sectors of society have been formulated. The feasibility of making comprehensive master plans for the conservation and utilization of groundwater resources, lakes and rivers and geothermal resources is being investigated. The environmental impacts of hydropower developments are being fully integrated in the master plan. A comprehensive cross-sectoral administrative framework for the collection and dissemination of environmental information and the development of environmental statistics and indicators has been developed. A national accounting system which includes the implications of economic activity for the environment and natural resources has been established. Public participation is being enhanced through the implementation of recently passed legislation, by which the public is to be provided with information on environmental affairs through the publication of a state of the environment report.

83. In the Netherlands, government policy on the protection of freshwater is contained in the Third Policy Document on Water Management. This is based on the principle of integrated water management, which involves safeguarding both the quantity of freshwater in the Netherlands, and the chemical and biological quality of the water itself. In the first place, the policy concentrates on effecting considerable reductions in industrial, domestic and diffuse discharges. The Netherlands now has one of the highest levels of sewerage and water treatment in the world. The wastewater of more than 92 per cent of the population is completely purified by the biological-oxidation method before it is discharged. Almost all industrial wastewaters are also purified. In addition to reducing emissions, measures are also being implemented to improve the environmental quality of surface water.

84. The Government is taking steps to curb increases in water consumption by households by encouraging people to save water. In households, this includes promoting the use of water-saving toilets and washing machines. In industry, the emphasis is on water used for cooling and other processes. Policy measures to combat water depletion have been stepped up in recent years. A target has

been set to reduce the areas affected by water depletion by the year 2000 by 25 per cent of the 1985 level.

85. The United States of America is working towards the goal of achieving a holistic approach that treats water resources as an integral part of an ecosystem, a natural resource and a social and economic good. Partnerships between the national Government and State and local governments are considered essential to achieving progress on water resource issues, as is the participation of non-governmental groups, industry and interested parties from the general public. The creation of effective partnerships with neighbouring countries is considered critical to management of transboundary water resources. Stable institutions, such as the United States/Mexico International Boundary Water Commission and the United States/Canada International Joint Commission, promote better management of shared resources.

86. The management of non-point source pollution is the most urgent water quality problem that needs to be addressed. The Environmental Protection Agency (EPA) has issued guidance for coastal states for achieving reductions, requiring that they implement the management measures through the use of enforceable mechanisms and policies.

87. EPA has worked with States and communities to develop wellhead protection programmes to protect drinking-water supplies. These programmes concentrate on protecting a community's underground sources of drinking water by delineating the groundwater resources around the community's well and by identifying the potential sources of contamination that could affect the groundwater.

B. Developing countries

1. Africa

88. In spite of the bleak assessment of the situation in the region, there is evidence of an increasing recognition of the importance of implementing the recommendations contained in chapter 18 of Agenda 21. The East Water Resources Seminar held in Entebe, Uganda from 24 to 27 May 1993, with the support of the Government of Denmark, agreed that the development and management of water resources in the East African region should be based on the general principles and guidelines emerging from the preparatory process of UNCED. It recommended that national water resources policies should follow general decentralization principles, and that guidelines should regulate the various roles, functions and decision-making processes at different levels. Participation at all levels, especially the private sector, should be promoted.

2. Asia

89. In October 1993, the State Planning Commission of China, together with the State Science and Technology Commission, issued a document entitled "China's Agenda 21". The document contains a chapter on freshwater resources, which includes a programme on the protection and sustainable development of natural resources. The objectives are to formulate long-term plans of water supply and

demand, and rationalize water resources based on an assessment of water resources; amplify necessary rules and regulations to develop rationally and protect water resources; improve water quality and supply capacity, and control water pollution; reform water resources management system and improve efficiency of water utilization; control domestic and industrial water consumption to alleviate water shortage and pollution; protect the aquatic ecosystem based on the interrelation of water, forest and land use; forecast climate change impacts on water resources, and formulate and pursue related policies for adoption.

3. Latin America and the Caribbean

90. In Bolivia, the environmental law of April 1992 established political and ethical principles for the protection and conservation of the environment and natural resources. The law establishes that the State will promote the integrated planning, development and use of water resources and will regulate the integrated and rational use, protection and conservation of water resources. The formulation of new water legislation is under study.

91. In Chile, the reform of the Código de Aguas (the water law), the creation of the Dirección General de Aguas (Head Office for Water), the replacement of the Dirección de Obras Sanitarias (Sanitation Works Administration) by the Superintendencia de Servicios Sanitarios (Superintendency for Sanitation Services), the creation of the Comisión Nacional de Riego (National Irrigation Commission) and the promulgation of the Ley de Fomento de Riego (Irrigation Improvement Law) have been among the most significant reforms. The result of these changes has been to change the thrust of the action of the State from that of almost complete responsibility for all aspects of water development and management to that of one of responsibility for the resource and of supporting and supervising user actions.

92. The reformed water law, although maintaining water as a public good, establishes private ownership over the water right once it has been granted by the State. The right can be freely transferred on the open market. Among the most significant innovations has been the establishment of one national body with comprehensive responsibilities for water resources data in the water directorate. From the water management viewpoint, equally significant are the reforms in the authority and responsibilities of the organizations of water users and in the role of public authorities in the management and construction of irrigation works.

93. Mexico, although a federal State, has, for a number of years, enjoyed a highly centralized system of water administration. This system has recently undergone a profound revision, which has changed the basis on which the administration operates. The Comisión Nacional del Agua (CNA) was created in January 1989 to replace the Secretaría de Recursos Hidráulicos and to concentrate responsibility for water management in one institution. Other government agencies, however, have responsibilities in respect of various aspects of water management. CNA is responsible for managing the supply of water and for the assignment of the right to use water. CNA must determine the natural supply, the water balance and the annual availability of water. Water rights are granted for a period of not more than 50 years, and can be revoked if

the use of the water is changed. The management of water use lies with a variety of institutions at the public, federal and state levels and with the private sector.

4. Western Asia

94. In Yemen, a new water law designed to provide for the licensing of new wells and for a more orderly set of arrangements for water abstraction, is being considered by the Government. In order to improve the institutional framework for water resources development and management, a proposal to integrate various water-related functions under one government institution is receiving serious consideration. The Government has established the High Council for Water, supported by a technical secretariat, in order to improve the water sector planning. The technical secretariat has been entrusted with the task of preparing a National Water Master Plan for the country.

95. Similarly, Oman has established a Ministry of Water Resources in order to institute a comprehensive management of its water resources by a non-user institution.

C. Economies in transition

96. In Estonia, a goal of the Tallinn Environment Project Feasibility Study is to improve administrative structures, as well as legislation and standards for water management. The project takes into account the economic value of water with a view to increasing efficiency and the generation of financial resources.

IV. CAPACITY-BUILDING, TECHNOLOGY AND FINANCE

A. Capacity-building

97. The decay in the ability of many countries to deal with the assessment of water resources, both from a quantitative and qualitative point of view, the fragmentation of water management responsibilities among numerous government ministries and departments, the inability of many government agencies in developing countries to attract and retain trained personnel, the lack of policy frameworks defining the nature of government interventions and strategies for water resources development and management, and the lack of suitable legislative frameworks, suggest that institutional constraints constitute the major obstacles to the implementation of the recommendations for the sustainable development of water resources contained in chapter 18 of Agenda 21.

98. There is an increasing recognition by Governments of the importance of capacity-building in this respect, and a number of such Governments have carried out, or are in the process of carrying out, water sector assessments with a view to producing a diagnosis of their situation and formulating strategies for the future.

B. Technology

99. Given the ever-increasing demands on a limited stock of freshwater resources worldwide, the development and use of technologies aimed at augmenting water supplies, limiting pollution and conserving the resources is essential, particularly in developing countries and economies in transition.

100. Technologies for augmenting the supplies of water resources are commanding greater attention. By 1990, desalinated water from sea and brackish waters and treated wastewaters in Western Asia provided the equivalent of 6.5 per cent of the total available freshwater resources in the region, and the proportion is expected to increase to 7.4 per cent by the year 2000. The installed desalination capacity of the Gulf countries amounts to 49.5 per cent of the total world capacity. 8/ While desalinated water is still too expensive for agricultural uses, it can play an important role in providing water for certain industrial purposes and for the tourist industry, particularly in island countries. The treatment of wastewaters is fast becoming critical as a source of water mostly for agricultural uses, and as a means of decreasing the amount of pollution discharges into freshwater sources. The transfer of this type of technology and the dissemination of health safety standards for their application are essential for developing countries.

101. The use of water-saving technologies will have to become far more widespread in the near future, especially in developing countries. These technologies will be of particular importance in the case of agricultural water uses, where, globally, around 70 per cent of water withdrawals are for agriculture. The overall proportion of water used for agriculture will need to drop to 62 per cent by the year 2000 because of increasing demands for competing uses. 10/ Currently, withdrawals for agricultural uses account for as much as 91 per cent of the total in low-income countries. Similarly, the profligate use of water by the urban rich in many countries will have to be curbed.

102. Equally important to developing countries and economies in transition will be the increased use of clean technologies. While there may be a temptation to settle for less capital-intensive more-polluting technologies with a view to maximizing short-term economic gains, such gains will, in most cases, prove to be illusory in view of the environmental and health costs incurred which will have to be faced in the future. The proper use of the "polluter pays" principle will be instrumental in promoting the use of cleaner technologies.

103. An important lesson that has been learned from the International Drinking Water Supply and Sanitation Decade, which can also be applied to other sectors, particularly in the case of small-scale irrigation, is the importance of adopting technological solutions that are appropriate to the specific needs of the community in question. The appropriateness of a given technological solution, in addition to being a function of cost, is also related to the suitability of designs to the needs and aspirations of the community, the ability and willingness of the consumer to pay, and the operation and maintenance requirements of specific technologies relative to the capacity of communities to carry out these functions. Close consultation with users is an essential element in a successful choice of technology.

C. Finance

104. The financial resources needed for the implementation of chapter 18 of Agenda 21, if they are to be met, will require increased efforts from Governments and the international community, as well as increased contributions from users. So far, indications are that financial allocations from various sources are falling short of the mark.

105. As mentioned earlier, water resources assessment activities have suffered from neglect in recent years as a result of dwindling financial allocations. All too often, the economic value of water resources data has not been recognized even though such data are essential to development activities. Due to the frequent fragmentation of responsibilities among governmental ministries and departments, organizations dealing with water resources assessment are not sufficiently linked to those dealing with development and management and, hence, do not receive the necessary support, nor do they necessarily produce the data required for development when and where they are needed. The current situation clearly suggests that greater attention to this issue is also needed at the international level. The WHYCOS programme (see para. 72 above) has not as yet found financial backing.

106. In view of the increasing scarcity of water resources of a sufficiently good quality, and the rising costs of securing adequate supplies, there is a need to stress the economic aspects related to development and allocation of water resources. Increasing attention needs to be given to user fees and to the issue of subsidies. In the case of water supply and sanitation, case studies have shown that a number of peri-urban poor communities are in fact paying very high fees for water from local vendors and that they would be able and willing to pay for services from local utilities providing better services at a lower cost, particularly when the design of the services provided complies with their requirements. Where subsidies to the poor are deemed to be essential and where such subsidies are not financed through cross subsidies from higher-income communities, the incidence of the subsidy should not fall on the public or private utility providing the services, as this would impair the operation and maintenance capability of the utility as well as the capability to generate investment capital. Unless there are clearly demonstrable social reasons for it, subsidies should not be given to higher income groups. In this regard, the WHO/UNICEF Joint Monitoring Programme has found that "Governments are subsidizing water systems and sanitation services to the better-off populations by around 70 per cent of recurrent costs, as compared to approximately 50 per cent towards the lower levels of service provided to the urban low-income and marginal areas, and less than 40 per cent of the much lower operation and maintenance costs (O&M) in the rural areas". 17/

107. Irrigation projects are some of the most heavily subsidized economic activities in the world. In some cases, subsidies to irrigation covered 90 per cent of the total operating and maintenance costs. 18/ The magnitude of such subsidies not only limits dramatically the generation of funds for operation and maintenance and for capital investment, but also introduces serious dislocations in the allocation of water resources among competing uses that will not be sustainable in the future in view of increasing demands. The question of user fees for irrigation is closely associated with the

appropriateness of scale and design in terms of affordability and capacity for operation and maintenance.

108. The "polluter pays" principle needs to be given the closest possible attention in order to generate the financial resources for treatment and to induce the use of cleaner technologies. The concept of trading permits is gaining in acceptance both in the United States and in the United Kingdom of Great Britain and Northern Ireland, in the case of air and water pollution. Under this concept, polluters are able to trade pollution allowances within an overall limit. This approach may motivate companies to invest in more efficient pollution abatement technologies, enabling them to reduce discharges below the permissible limits and to sell the balance to other companies for a profit. Other companies may in turn find it more economical to purchase pollution allowances as the lowest-cost alternative to compliance with pollution standards.

109. The private sector is playing an increasingly important role as a source of investment capital and in the operation and management of water resources utilities. This is the case not only in industrialized countries, such as the United Kingdom and France, but in many developing countries as well. The potential benefits of intervention by the private sector in developing countries are evident, not only in terms of the flow of financial resources, but also in terms of bringing technical and managerial know-how and providing financial and managerial autonomy to utilities.

V. CONCLUSIONS AND PROPOSALS FOR ACTION

110. Early feedback from the follow-up to the International Conference on Water and the Environment and to UNCED indicates that there is greater acceptance of the importance of a suitable enabling environment and for the concept of integrated water resources planning. Similarly, the concept of water as a scarce resource and as an economic good also seems to be gaining acceptance.

111. There is a trend towards decentralization of authority and a separation of functions between organizations responsible for policy formulation, and those in charge of implementing projects and managing utilities. There has also been an increasing awareness of the importance of the role of women in the management, development and utilization of water resources. Unfortunately, however, data on the extent and impact of women's participation are lacking. The lack of information for planning and decision-making and an inadequacy of monitoring capabilities are still pervasive problems in developing countries. This refers not only to the assessment of surface and ground waters, both in terms of quantity and quality, but to water use and to the interrelationship between land and water as well.

112. Very serious problems persist, and in some cases these problems are becoming alarming. While considerable progress has been made with regard to the eradication of some water-borne diseases, notably guinea worm, the outbreak of cholera in recent years illustrates the possible magnitude of an impending health crisis, particularly around urban concentrations. More and more rivers, recipients of untreated urban waste discharges, are becoming open sewers, and

pollution from the indiscriminate use of agro-chemical products is often rampant. Equally alarming are the increasing levels of pollution from the disposal of toxic chemicals. Water resources of suitable quality are becoming scarce and increasingly expensive.

113. Recent international forums dealing with water resources issues have all brought about an increasing awareness of the global magnitude of an impending water crisis. There is a growing consensus among experts in the water resources field about the seriousness of the situation. However, the spectre of a global water crisis has been overshadowed by concerns about other issues of manifest global proportions, such as the ozone layer, tropical forests and climate change. Internationally the seriousness of water problems has not as yet received the recognition warranted by the situation. At the national level, particularly in developing countries, whatever measures have been taken, albeit in the right direction, have generally not been commensurate with the scope of the problems. Water resources will not receive greater priority unless a strong case is made to this effect, and international attention is focused on the need to assess the real magnitude of the problem and bring about effective solutions.

114. Information concerning the availability and quality of surface and ground waters is often insufficient, and in many cases the capacity to collect data has been waning. The situation is even less satisfactory with regard to water resources uses, waste-water disposal, the interrelationships between population, land and water, and the impact of the application of economic and legal instruments to water resources use and pollution control. Due to a lack of integration between water resources policy and planning and economic policy at the national and regional levels, whatever information might be available fails to find its due place in the national policy-making and planning process.

115. There is clearly a need for Governments to embark on a major effort to monitor key socio-economic, physical and environmental variables related to the assessment, development, utilization and management of water resources as an essential condition to progress. As a matter of urgency, Governments need to develop and implement monitoring strategies for the collection, analysis and dissemination of data of demonstrable value, including the formulation of methodologies for evaluation of environmental variables. Equally, at the international level, there is an urgent need for the systematic gathering of information on the availability of the resource, including water quality data, and on the demand for water for various uses, with a view to providing reliable assessments of the state of the water resources of the world.

116. The formulation of policies and the implementation of holistic strategies presupposes the existence of institutional structures which achieve a high degree of horizontal integration within the various sectors of water resources, including management structures at the lowest appropriate levels and vertical integration with the national socio-economic planning process. If significant long-term progress is to be achieved in the implementation of chapter 18 of Agenda 21, priority attention needs to be given to the establishment of "a dynamic, interactive, iterative and multisectoral approach to water resources management, including the identification and protection of potential sources of freshwater supply". 19/ To this effect, Governments should consider the need to carry out a diagnostic assessment of the current situation *vis-à-vis* their

current institutional arrangements and human resources capacity, with a view to formulating a strategy and an action plan for the years to come. Priority attention needs to be given by the international community to capacity-building programmes in support of efforts by developing countries and economies in transition.

117. Financial support for the implementation of the recommendations contained in chapter 18 of Agenda 21 has significantly fallen short of requirements. At the national level, while there is a need for Governments to increase the share of development funding allocated to water resources, such as in the case of water resources assessment, urgent attention needs to be given to the implementation of pricing policies that take fully into account the user's ability to pay. Governments need to ensure that subsidies, when given, do respond to the social and economic needs of the needy rather than being granted to middle- and high-income strata of society. Serious consideration needs to be given to the role of the private sector in generating financial resources and as a provider of services. Funding by the international community has also fallen short of the mark.

118. In terms of the activities of the organizations of the United Nations system, major efforts will have to be made in order to assist Governments in a concerted manner with their capacity-building efforts and in the development of strategies for the implementation of chapter 18 of Agenda 21. The development of a global implementation plan incorporating guidelines and schedules for the implementation of the chapter and the establishment of an information network for the assessment of the freshwater resources of the world, if approved by the Commission, will require high levels of cooperation among the organizations above and beyond the levels of their current programmes, and will also require close cooperation and support from interested Governments and intergovernmental and non-governmental organizations.

119. As is the case for ACC and its other subsidiary machinery, the ACC Subcommittee on Water Resources remains a forum open only to the organizations of the United Nations system. Nevertheless, contacts with other external support agencies, non-governmental organizations and professional and scientific organizations take place through the Subcommittee's working groups and through seminars, symposia and technical consultations convened by the various organizations. The most permanent and systematic forum for a wide dialogue among all the organizations concerned is to be found in the form of the Collaborative Council for Water Supply and Sanitation, which meets every two years and has a small secretariat based at WHO headquarters. Regarding the formulation of concerted approaches to integrated management of freshwater resources, the need for further dialogue remains.

Notes

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2/ See World Commission on Environment and Development, Our Common Future (Oxford and New York, Oxford University Press, 1987).

3/ Food and Agriculture Organization of the United Nations, Agriculture: Towards 2010, document C93/24 (Rome, November 1993), p. 15.

4/ Ibid., p. 232.

5/ Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

6/ See the report of the Secretary-General on Institutional and legal issues in integrated water-resources management (E/C.7/1994/6).

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19/ Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, chap. 18, para. 18 (a), vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II, para. 18.9 (a).